

SPACE TOWN HALL MEETING

15th National Space Symposium

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Moderator: Welcome back, everyone. Town Halls have been an American way of life since our society began. They have always been an excellent way of getting to know the issues better and providing the people an opportunity to directly interact with decision-makers. The United States Space Foundation has been exceptionally fortunate to gather together three of the most important figures in space today to provide an interactive town hall. Moderating this event is a man who has left his own indelible fingerprints on space, Norman R. Augustine, Professor of Engineering at Princeton University. Before joining the staff of Princeton, Mr. Augustine served in numerous distinguished positions including President, CEO, Vice Chairman and Chairman of Lockheed Martin. It is a privilege and an honor to turn the floor over to Norm Augustine.

Mr. Augustine: Thank you very much for that kind introduction. I must confess it's taken me a while to get used to being called Professor. When I first went to Princeton two years ago to teach the first lecture I gave, the Dean was kind enough to introduce me-this is a true story-and I was sitting at the platform flipping through my notes not paying much attention to what he was saying and all of a sudden I heard the Dean say, "Now we'll hear from Professor Augustine." And the first thought that went through my mind was "Gee, what a coincidence. They've got some guy here by the same name as me."

But at least today I knew to stand up when I was called on and I am happy to be able to participate with my three colleagues today in this town meeting. Of course a town meeting, as we just heard, is a very special kind of thing in Americana. And it not only requires superb, knowledgeable panels, which you see before you, but it also requires the participation of the audience. And to that end we're going to count on you for most of the time to provide us with questions you would like our panels to address. And you should have a card on your seat on which I hope everyone will write as many questions as you would like and pass them down to the aisles and they will be picked up at periodically. And if you want to sign the cards, feel free to do that. If it's

kind of a nasty question you need not sign the card. If it's a really nasty question you can sign your competitor's name. Whatever you want to do is just fine with the panel.

This panel we have today is extraordinarily qualified to deal with the question of where do we go in space and how are we doing today. This panel, I might also add, has disproved one of my laws. When my first book of laws came out, I have one law in there that was not greeted in many circles very well. In fact, General Vuono, who was Chief of Staff of the Army at the time, told me that he didn't think much of my laws, and particularly this one. As I say this panel has just disproved it, but the law I refer to is the one that says rank times IQ is a constant. Well, not only are the members of this panel the most senior ranking officers or officials in their own organizations. But as you know and as you will see again today they're perhaps as insightful a group as one could hope to find. So we have both seniority and insightfulness.

I last had the privilege of speaking at this particular meeting five years ago. And at the time three quotations came to my mind as I looked forward to kind of the next five years of the space program. And I dug out my notes from the prior meeting before coming here and I'd like to share those three quotations with you. They come from Charles Darwin, President John Kennedy, and from Winston Churchill.

The quotation from Darwin is the one that says that, "It's not the strongest of the species which survives nor is it the most intelligent but rather the one that's most adaptable to change." And I think that speaks of the space program as a whole but certainly to the organizations that these three individuals represent which have undergone immense change.

The quotation from President Kennedy is one when he was actually speaking of the space program. You may remember it. He was speaking of the Apollo program in fact and he said, "We do these things not because they are easy but because they are hard." And that quotation particularly came to my mind five years ago on this occasion because I was concerned whether America was becoming so conservative and risk-adverse and that the penalties in the media and Congress and public scrutiny for failure were so much more intense than the rewards for success that I was afraid that America might be backing off from setting grand goals of moving ahead. And thank goodness that has not been the case. We have moved ahead and markedly so, but in a very different fashion thanks once again to a very large degree to the three gentlemen at the

table.

The third quotation comes from Churchill and occurred to me particularly at this moment five years ago. The quotation I refer to is the one where he said, "Americans will always do the right thing-after they have tried everything else."

And I was concerned at the time that we might not have a strategy for space and that we might in fact because of the constant turmoil of the budget find ourselves drifting in space-lost in space. And once again happily, while I'm sure that for all of us there are aspects of the program that we might have done a little bit differently, the fact is that we do have a strong space program. And given the size of the budget, a remarkably strong space program in which I think we can take great pride. There was the concern I had at that time-that many had-that we might turn away from the space station when we started to encounter some technical problems which you always encounter in hard programs. Or that we might lose interest in the planetary program or that DOD would turn away from space as it tried to maintain a large force structure. Or that commercial space might be lost to foreign government-backed companies. Or a host of other things that one might worry about. But change we did. I think Darwin was probably talking about the space program when he made his comment. And we have come a long way since a decade ago in ways that would have been difficult to imagine. For example, the strong partnership between US space industry and our government and the Russian space industry and their government. It's a partnership that although challenged with budgetary issues has been I think successful as a whole beyond what most of us would have imagined. Another change of course has been the fact that we have more commercial launches now than government launches somewhat changing the basic economics and the roles I might say of the space program itself. We've seen unimagined commercial uses of space spun off from government investments and everything from GPS to images of the ground. And in fact people in America have come to take the space program so much for granted I believe.

And Dan if you'll forgive me for telling a story that you told me and I hope this wasn't the opening to your speech. But Dan told me a story about how someone was criticizing NASA for spending so much on the meteorological program. And this citizen said, "Why do we need meteorological satellites we have the weather channel?" Was that your

opening, Dan? Ok.

Whatever the case, people do take for granted things from space that affect our lives rather profoundly. And if you happened to read USA Today, on the front page there was one such example of such things. Something I hope doesn't affect the lives of anybody in this room profoundly, if you've read it. If you haven't, go buy USA Today. But there are major issues that still remain.

Obviously there's the question of what should be America's policy on cooperation and technology and including space with nations whose human rights policies differ from our own. There's the question of how do you protect the technological advantages of our country including its industry and at the same time compete and be involved in the world market place? The question of will we be able to afford an active program to place humans on Mars and should we do that? What could be done to reduce the cost of space launch and operating in space? What are the military space needs in an age when the principle threats are terrorists and basically paramilitary forces more than they are tank armies and battle groups? The question of should the nation defend itself from ballistic missiles and if so what role should space play in that defense? What are the military capabilities for monitoring and locating items on the ground? To what extent should our military be dependent upon our commercial sector not just for supplying hardware but also for operating support and for services? And is the educational system of America going to provide the people and the engineers with the talents we're going to need to maintain a robust space program? What should be the national plan for spending on space? What should be the budget? Those are just a few of the questions that can come to mind so the challenges remain.

The people who will answer many of these questions and who have led us through the thicket of uncertainty of space these past few years are represented and in fact in person in many respects the panelists that we're going to hear from. Each of the panelists is going to make some opening remarks that hopefully will trigger questions in your minds and give them a chance to say what's on their minds. I'm going to introduce all three of them right now together so that I won't have to keep jumping up and down and taking their time. I'm going to make the introductions very brief, which I hope they will understand. And I'm going to do that first because they're well known to each of you and second because I'd like not to

detract anymore from the time that's available to the panel and to you for your questions. I'm going to ask our panelists to speak in alphabetical order and so I will introduce them in that order; again, very briefly.

First, of course, is Dan Goldin, a great leader, a change agent and a man of enormous courage. He's a man who lives one telephone call away from being in the middle of crisis and has lived that way for some time. He's as far as I know the highest-ranking person in our government to have served both under the previous Republican administration and the current Democratic administration and to have had the broad respect of both those administrations. Some of his new ideas and the cultures he's introduced have become household words in our community. And the one that particularly comes to mind-I say one because we treat it like one word-"faster, better, cheaper." Dan is a graduate of the City College of New York. He has a Bachelor of Science in Mechanical Engineering. He spent 25 years at TRW and rose to the rank of Vice President and General Manager of the Space and Technology Group. He of course today leads America's civil space program in his capacity as Administrator of NASA.

Keith Hall, a dedicated public servant, an expert in intelligence matters and a key architect in our changing military space program. He served in a broad array of high-level government positions dealing with the space program, positions spanning from the White House where he served in the Office of Management and Budget, to the Congress where he was Deputy Staff Director of the Senate Select Committee on Intelligence, to his service in the Pentagon and other important capacities. He served nine years in Army intelligence and holds a Bachelor's degree from Alford University and a Masters in Public Administration from Clark University. He now is the Assistant Secretary of the Air Force and Director of the National Reconnaissance Office.

Our third speaker, General Richard Myers. Dick is a patriot above all else, a military leader, and a superb pilot. He began his service to our nation 34 years ago when he entered pilot training. He became a command pilot with 3900 hours including 600 hours, about 1/6 of that total number of hours, in combat in the F4. He rose to become the Commander of Pacific Air Forces. He's a graduate of Kansas State University where he was in the Reserve Officers' Training Program. And today he is Commander in Chief of North American Aerospace Defense Command and U.S. Space Command, and

Commander of the Air Force Space Command.

Those are our three panelists. I'm proud to introduce them and I hope as they speak, you will begin writing the questions you would like for them to address. First then, Dan, if you don't mind starting out.

Mr. Goldin: I'd like to keep with the theme that I brought up in this morning's talk and I want to focus very, very narrowly on the whole issue of access to space-getting from the surface of the earth to low earth orbit. And I have a few charts. I never use charts but I thought in this case it would be very worthwhile, so let me show the first chart.

Here's a chart that was developed down in NASA Houston by Bill Reedy, who is the Deputy Head of the Office of Space Flight. And it's a very, very illuminating chart because if you take a look at the lower left hand corner over here you will see the X34, the SR71, the solid rocket boosters, the X prize, the X15, and the DCXA. And take a look at the amount of energy that is being imparted and take a look at the altitude- 50 miles is considered the limit of space. And this X prize is wonderful-- it'll take two people up to 50 miles and then bring them right down. The point I'm going to make is you can't extrapolate going to space from all the work that's going on in this lower left hand corner. We're taking the next step with the X33 but even that if you take a look at the energy and the mach number-about mach 15-and compare that to what we need to get the geotransfer orbit, the space station orbit or to service the Hubbell; it's more than a factor of three less energy. That is a very long way to go and we can't extrapolate that we're suddenly going to have a VentureStar because we fly an X33. Nor should we get all hot and sweaty-I think it will be a wonderful achievement and I don't want to demean what the X prize is-but to extrapolate sending people to the moon because we had the X prize-or extrapolating that a vertical takeoff and vertical landing system is going to work because we did the DCXA is a long, long extrapolation. That's the point of this first chart. It also says going to space is difficult. It also says that the shuttle is a miraculous, miraculous achievement for the United States of America. Because that shuttle goes all the way up here and comes back down. And there's no other machine in the world that could do it and there's always a lot of criticism passed of what the shuttle does but until something beats that, that's the reference point for all future launch systems.

Next chart. We talk about going into space and I just wanted

to put down what it is that a reusable launch system does and maybe the next generation system won't do all this. But let's take a look. The shuttle is a human rated rocket ship for 8-1/2 minutes. It's a spacecraft from ten days to two weeks, being a habitable research platform capable of rendezvous, docking, deploying, retrieving, repairing and supporting space walks for space emergencies and space construction. It then becomes a hypersonic reentry vehicle for an hour. And then it becomes a piloted subsonic glider for about five minutes. When people want to go and design new launch systems and make them reusable, it's not just a question of going up which from the prior chart, said is super difficult. One has to consider all these things. And it is not clear yet whether we will have to include people with the cargo on a reusable launch vehicle because of the necessity for space operations, which we're finding more and more about. So as one thinks about the design of a new system, it's not just going up. It's doing all these things.

Next chart. We took the cost. What did it really cost to develop new systems? And up here we see it took about eight years and \$50 billion dollars to build the Saturn V; about \$40 billion for the shuttle; from the redesign point on about \$24 billion dollars to build the International Space Station. Look at Sky Lab here at \$20 billion; the lunar excursion module is a little under \$20 billion. And we've enveloped the region. There's a number that's bandied about for the reusable launch vehicle, which is actually second generation, of about \$5 billion. But at the minimum threshold level, we are saying we need more technology risk reduction measured to the tune of about a billion dollars. Lockheed Martin is estimating maybe about five billion dollars for the development, production and certification. But we can't stop there. That's for a cargo vehicle. If we want to put people in it there's an estimate of three to five billion dollars to put a part on or to incorporate people into that vehicle. And then perhaps another five billion dollars of things we don't know about. So we put this crosshatched region in here and I put it down to say, and this is to give a little bit more substance to the point I was making, if we could pull this off in six to eight years for anywhere between \$5 billion and \$15 billion dollars, compared to what's been done before, it will be a miracle. I'm concerned about all the hopes and dreams of doing the kind of missions you saw on the prior chart for hundreds of millions or just a few billion dollars. Now, if it could be done, I will stand and I will applaud. But we set unrealistic goals as a nation if we underestimate what it takes; we don't openly talk to the

American public about the cost involved; and to the contractors, who will be our partners to make the investments, about what's involved. This is a big deal and that's what this chart is trying to say.

Next chart. I want to go back in history so we can compare where we are in space to where we are in aviation. The Wright Brothers flew, in 1903, a one-seat 40 miles per hour and 30 years later, or 50 years later, we got up to 360 miles an hour, 105 seats and then we got to the 707 just about 50 years later with the turbojet. That was a very long gestation period and it took about 25 years just to go from the Wright flyer to the Ford tri-motor which was really in effect the first commercial airline. So if you take a look at the time scales, it is not unreasonable. And then the unfortunate part, which is the point I was trying to make this morning, from 1954 until 1994 -1999 we made small evolutionary changes but nothing fundamentally different has happened to the airplane. My concern we're going to get so comfortable by making small evolutionary changes-and I don't want to demean programs like the EELV-I don't want to demean private activities going on-we've seen it happen in other parts of our economy. If we get too comfortable in America as a nation with making small evolutionary changes to those systems, space will be a commodity just like aircraft and we'll never leave earth orbit. That's my next point. Last point. Oh, by the way, I neglected the Concorde in here and I should not neglect it because the Europeans did something unbelievably bold, unbelievably risky and they got the first units up. But we couldn't get the rest of the way. And hats off to the Europeans for their courage because we in America just failed our second time at trying this and that was in 1999.

Next chart. If you take a look at the shuttle--three to seven flights a year; depot maintenance every ten missions; one hundred mission design life--I don't know how many years--and see where we really need to be if it's going to be economical. And there is a very, very big canyon in between and my supposition is that will not happen in the next few decades without unbelievable, revolutionary technological improvements that's going to have failure and risk. I also contend we'll have to look at many different approaches and in the next decade or two, fly perhaps three or four dozen experimental vehicles. We'll have to design a little, fly a little, crash a little, build a little, test a little and keep repeating it until we get there. And we'll have to make a significant, significant R&D investment to move this system along. With

that, I'm now going to stop. Thank you.

Mr. Hall: You know it wasn't too long ago if there was a town meeting on space the NRO folks would be offered the backroom of the town meeting hall. And I'm very glad to be a participant. Not only for myself but for other folks from the National Reconnaissance Office.

One of the things that challenges us is the declining budget. And one of the advantages of coming out into the open as it were is the ability to work more closely with some of the other players in the space business.

And we spent a lot of time over lunch talking about the partnership difficulties and opportunities and successes in this realm. And I'm reminded of the story of the different types of partnerships that exist. The one that I like the best is the partnership between the veterinary and the taxidermist and the motto that they came up with which was "Either Way You Get Your Dog Back." I think that the partnerships that I'm going to talk about are ones that aren't of that mold, but ones that seek a common ground across the various players and allow us to leverage the dollars and the shrinking dollars that are available to us to get the job done.

The other thing I want to talk about is integration. And I'll say a few words about that because I think that being able to come out into the open allows us to take up the challenge that Admiral Dave Jeremiah gave the NRO three years ago-which basically was, "You folks aren't just in the building of spacecraft business. You're really in the information business and you need to think about that." And that presents some integration challenge.

So let me have my first chart. There's a lot of activities we have underway that I think began with our predecessors. Howell Estes is here, Jeff Harris here-who really began a lot of these efforts themselves. And what we are attempting to do now is to institutionalize them so that when the personalities change these partnerships will flow.

And here's some examples of some of the things that we're doing. The Partnership Council that's been mentioned is regular meetings between Dan, General Myers and I with considerable work going on by our staffs to find ways to cut across the civil, the military, and the intelligence space arena and identify areas to get the job done better. The Space Technology Alliance which is allowing us to align our R&D

programs in very dramatic and important ways. We're now cooperating across all elements, for example, in optics with a heavy reliance on the work that NASA is doing on the follow-on space telescope. And a variety of other areas. But the important point is that we're looking for ways to institutionalize the efforts across programs that we have started.

Next chart. Now when you take the concept that the NRO is not just in the satellite sensor business, we're in the information business, it opens up sort of a different way of looking at the types of interactions that we have to have. Looking at the upper left here-the first challenge we have is integrating ISR-intelligence, surveillance and reconnaissance. I think it's abundantly clear that users of information really don't care what the source of the data is--whether it comes from a satellite, an airplane, a ground sensor, or what have you. What they're interested in is a reliable way of getting accurate information in the timelines that they require. And that places a burden on us, the sensor providers, to find ways to integrate across all those sensors. And we have numerous projects that are underway across airborne and satellite systems for example to do that. The other is in the area that I'll call the ops intel integration in the organize, train and equip missions of the military. It does us little good to figure out ways that we can bring information to the warfighter if the military services do not organize, train and equip themselves to utilize this. And we've seen in the past, like in DESERT STORM for example, there's a great ability to collect information, analyze it and the rest. But if the military services don't have the wherewithal to receive it, which is really an organize, train and equip mission, then it will be left to bubble gum and bailing wire to sort out getting the information. And sometimes that doesn't work very well. So we have a major effort with the services which I think are bearing results to work closely with them. We have put a lot of attention into the Joint world. What is new is our effort to work with the services to give them the comfort level that they need to rely on NRO information as they go about their organizing, training and equipping mission which obviously is the necessary ingredient before you bring anything to a Joint world to have a fight.

Black/white space integration-and by the white world I'm not just talking about the military side but the civil side as well now that we're out in the open we're able to work across the boundaries to find ways to cooperate. I gave you one example

that's the large optics area. There are many others. And I think we need to recognize that in many of these sensor areas we as a nation might be able to build one very capable sensor. We probably can't build two or three-one for the civil, one for the military, one for the intelligence side. And there's probably no need to do that. But the challenges associated with the budget processes are probably the main impediment in that arena as each side has to compromise somehow and come up with a partnership and a funding arrangement to build single programs that can survive the test of time through the budget process. Probably the best example we have of that at the moment is the Discoverer Two program where we are working with DARPA and with the Air Force to build a space based radar demonstration capability. We'll see as time goes by whether or not that can withstand the perversities of the budget process that I talk about. Now we're exploring ways that perhaps NASA can participate in that.

Finally, the space ops integration. And here what I'm talking about is the application of space to an operator's mission. Frankly as a long-serving intelligence officer I don't worry a lot about whether or not my intelligence colleagues are figuring out ways to prosecute their intelligence mission using overhead satellites. I think the area that needs a considerable degree of attention is the folks who have other missions, whether they be diplomatic or military or civil disaster relief or what have you, thinking about how they might be able to apply our reconnaissance capabilities in ways that can serve their missions and allow them to get their job done. Because, after all, these sensor systems exist to support those missions. So that is an area that we are exploring significantly with providing better information on what these systems can do; providing better awareness on how they are tasked and what is the reliability of getting the information; sharing the information on both the limitations as well as the capabilities so that the operational community across the board is able to factor it in and figure out using their innovation and imagination how they can apply these tools to their mission. And there are many success stories that can be pointed to there.

Let me have the next chart. Now I want to just spend a moment talking about the R&D. The NRO has placed a significant priority on R&D like all the organizations in the national security arena these days. In the past the first things that people went to when the budgets got tight was starving of the future in order to finance the present. And we have made

a conscious commitment in the NRO that we need to be at the forefront working with industry on the type of technologies that will serve the nation's needs in this arena in the future. So we've doubled our resources going into R&D and we've done that in a variety of ways. I've already mentioned the partnerships with other agencies that are allowing us to leverage other resources. And we're co-funding various projects for the first time and we'll see whether they will survive the vagaries of the budget process.

And finally we are working with a new set of players in industry and that's another opportunity we have. In the past, we weren't able to work with very many people with broad area announcements or unclassified solicitations or even Secret level solicitations. Now we are actually doing solicitations in business commerce daily. We have solicitations over the Internet. And that is bringing in a whole new range of ideas into our business. So if some of you are trying to break into and find out the areas of interest that the NRO has hopefully you're finding an easier path to getting into that. And if not, send me a note or an E-mail and we'll see what we can do to facilitate it. Because we are identifying a lot of very innovative and exciting concepts for revolutionary improvements which is the path that we want to be on as a result of this R&D effort.

Let me have the last chart please. One of the things that I always got questions on in any forum was the area of commercial imagery and what is the NRO and the intelligence community's approach to the commercial industry business? And we have taken those questions and the criticism that has been levied at us to heart. And working with the National Imagery and Mapping Agency we briefed the main industry players on a concept that we have for about a billion dollar commitment over the course of the next five to six years to make the commercial imagery part of the nation's future imagery architecture. And this consists of a variety of efforts. First of all, data purchases in the order of about 300 million plus that we plan to spend over the next several years with more heavier spending in 04 and 05 because we are interested in promoting the development of second generation remote sensing systems. As you know the government is always interested in better resolution. Doing some of the work that is required in the intelligence field and the reconnaissance field is aided by better resolution. And we want to promote the development of a follow-on generation of better resolutions.

That obviously has policy implications that will have to get worked. And we have flagged that to the DCI and to the Secretary of Defense. But I think those policy issues can be worked. And what we would promise then is that our data purchases would about double in the 04 and 05 time frame and stay at that as a minimum level. And from time to time we might see purchases of a larger quantity beyond that depending upon the nation's needs. And I see that there are tremendous advantages to this. The other thing is major outsourcing by NIMA of the valuated work on imagery. There's about 500 million or so in that domain, 500 million plus. Heavy emphasis in the early years on geo-spatial. And some of the multi-spectral capabilities that industry will soon be delivering on orbit. And finally about a 100 million dollars or so in the area of infrastructure to allow the government to utilize these capabilities in a way that is part of the government's architecture. So I think that what you see is a sea-change in the government's thinking in this regard. There are some policy issues that lie ahead that I'm comfortable we'll be able to resolve. And we have committed to work with our industry partners on a regular basis to make sure that their views fit into this equation. Because it's not our desire to specify specific requirements or to guide the development of specific capabilities. We think that this is an industry best left to pursue what it sees as its commercial opportunities but it needs a strong commitment from the government to be a customer and we'll provide that.

I think that this is an exciting time to be in the space business. The annual expansion in this symposium is just an example of the growth in space and I commend Bill Knudsen and the folks of the Space Foundation for sponsoring this. I look forward to your questions. Thank you very much.

General Myers: Well obviously I'll stand up here and sing the praises of partnership but there's some disparities starting to grow and my staff said we didn't have the funding for slides. And also with my discussion yesterday morning about space control, I thought my two partners here would jump all over that either yesterday afternoon or today, but they took the wrong thing out of that speech. They jumped on the gold rush part and they said, "Hey Myers, let's go down to Cripple Creek and we'll just play some poker all night." Listen, with Dan Goldin and his Hubbell telescope and the kind of capability that Keith has, I'd have been fleeced for sure so this partnership may be falling apart even as it starts to flourish.

Actually, we had a great partnership meeting yesterday. It was one of our semi-annual meetings that's held here in Colorado Springs during this symposium. And if you'd like to know the kind of things and a little bit more detail about what we talked, then we have a press release that has some of the particulars in there that I think will help you understand the kind of issues that we worked. I don't know where this is going to be available, and I'm sure our Public Affairs may not even be prepared. But we've all coordinated on this, so it's ready to go as soon as they can get it printed.

There's another thing that came out of that meeting. I think it's interesting and we decided we wanted to announce today and it's known by a few but probably not known by many-and that is the effort that's currently underway by the Air Force to develop a secondary payload adapter for the EELV. And this is going to be done at a relatively low cost by the Air Force by the Space and Missile Center, their test folks out there in the Air Force labs, with the idea of having an Ariane-like capability that they have on Ariane IV and V to put small payloads into space somewhere on the order of 600 kilogram type payloads. This should for the first time in our country offer some of our universities and even the civil sector and the military sector some real opportunities to do some things that we haven't been able to do before. So I thought I'd announce that here as well and if you want more details we have some papers on that.

Yesterday we talked about space control and the idea was to say we've got to prepare for the threats of the future. I would add to that, that as we get ready for those threats of the future that we've got to consider the threat to our information. We've already downsized our armed forces and we counted on the fact that we would have tremendous leverage with our command and control computers, communications, intelligence, surveillance/reconnaissance assets, the information domain if you will-to leverage that decrease in forces to make us more efficient and more effective. But that's not without vulnerabilities as we all know and I think the Melissa virus in the last couple of weeks sort of proved that point. And although it was just annoying at the time because it affected things like the Internet and our E-mail but as you wean yourself from those systems to avoid the virus you find you actually have a lot of your capability in those systems as well, in our unclassified systems. That's as far as the Melissa virus went at the time but if we think the future is going to be

limited to that kind of threat then we're probably wrong.

Last September at my first Commander in Chief's conference where all the Unified commands get together it was decided, at least preliminarily, and approved by the Secretary of Defense that US Space Command would pick up the role for what we call Computer Network Defense/Computer Network Attack. And in October of 99 Computer Network Defense becomes the responsibility of US Space Command and by October of 2000 Computer Network Attack becomes our responsibility. As you might imagine this is not necessarily an area where we have a lot of expertise. We have a lot more now since we've been working and studying on this problem since September. We've tried to make this a very collaborative effort. We understand we don't have all the answers here in Colorado Springs and a lot of people have been working this issue. We take help from anywhere we can get it. In fact, we had Toffler and Associates in after Mr. Toffler gave his remarks in the morning. That afternoon we met out at Space Command and spent three hours with him discussing information operations, defense, attack, and specifically how we might go about creating new partnerships with industry like we have on the space side that would help us in this new mission that's coming our way. In the meantime we've got an implementation plan that's underway. It's supposed to be finished by the middle of May and it'll be just the first cut of course on how we intend to implement our new responsibilities. It has to go to the Chairman of the Joint Chiefs of Staff as I said in the middle of May. We're worried of course about all the things you worry about in terms of resources and so forth.

But we think that will all come once we get our plan put together. Exciting times I think. One of the big worries we have as we embrace our new responsibilities in this information defense/information attack realm is that we don't lose sight of our responsibilities in space. Because while information and space are absolutely related and that's probably why we got the task. I mean the fact that you think globally and this is a global issue and the fact that we work virtually in the space business and this is in many cases a virtual issue; this is probably not a bad place to put that responsibility. But at the same time we have responsibilities that are not related to information that we need to keep our eye on. So it's going to demand our constant attention that we don't lose sight of what we're trying to do in space at the same time we try to integrate our responsibilities for information

defense and computer network attack.

With that I think I'll stop. I was just asked-and I think I asked on behalf of my staff-for those of you in the audience that are the least bit interested in this-we're willing to listen and I'd like to hear whatever ideas you have or comments on that particular subject of information operations and be glad to take your questions. Thank you.

Mr. Augustine: Let me thank each of our speakers for their opening comments. We've had a number of questions come in which, if I don't drop them, they are semi-sorted, sorted not sordid! We welcome further questions as we go on and I would certainly encourage the speakers if I don't happen to call on you to chime in or to disagree with each other or whatever might please you.

Let me start with one for General Myers, which is as follows:
Do you feel it's important to have Allied participation in the national missile defense program? And the question specifically refers to Canada.

General Myers: I'll tell you what our assumption is here in Colorado Springs and it's an assumption that comes from the US military here in Colorado Springs. And that is that national military defense will become ballistic missile defense of North America and that the Canadians will be with us. That's our assumption and that's how we've gone about working all our plans. But the fact is the Canadians so far have not made a national decision in that regard and they are staying with us in terms of following the research and participating as some of our command and control observers in part of our command and control tests and so forth that we do. It's our hope that the Canadians will be with us. And then it would gravitate to a NORAD mission. My personal feeling is if that does not happen, that we might set up a dynamic in NORAD, and the secure relationship between our two countries might have an end state that we all don't want. It's been a very good working relationship up to now and I would worry if we don't get on the path together. But that's clearly a Canadian decision. We did have the Foreign Minister of Canada, Lloyd Axworthy, here about a month or five weeks ago and briefed him on the NORAD mission, on our past, what we're doing in the present and where we think we need to go in the future. He took that all on board and I think the discussions are starting in earnest now in Ottawa.

Mr. Augustine: Keith, would you want to add anything to

that? ... All right then. The next question is for Mr. Hall.

Mr. Hall: I think I have the drift of how to deal with the Chairman of the Panel!

Mr. Augustine: We have a quick learning panel as I told you! Ok, from the hard pile - *It has been said that we maintain four separate Air Forces in the Department of Defense which implies that we unnecessarily divide resources. Is this also true of satellite operations given that the Air Force, Navy, NRO, NOAA and NASA-that sounds like five-fly satellites? If so, is this division necessary, prudent and/or advantageous and is there any proposal to change this?*

Mr. Hall: Well I think that the whole space arena--now that the NRO is out into the open and space is taking on an increased importance in military operations generally--the whole space arena is on the path towards some type of transformation here. I would not quarrel with the fact that there are probably efficiencies to be made across the black/white space side and across the white side on space operations. And indeed one of the objectives in the formation of the National Security Space Architect, a single office that's looking at these type things, is to identify what those opportunities may be and to put forward proposals and ideas for all of us to consider. And I think that the space operations arena that will exist in the year 2010 will probably look like something a lot different than what it looks like today. But I think that the discussions on that are premature at this point. I think the most important question that we have to make is how might we integrate operations across the agencies and entities that currently conduct them in a way that integrates the information for the customer. And if we find that we can't do that without an organizational change, then I think the organizational change would be more acceptable. So I think that it is obvious that there are some efficiencies to be gleaned here. Part of the idea is in the partnership that is burgeoning between Space Command and NRO is to look at exactly those type of things in a dispassionate way, engage it and measure it against the end product to the customer as opposed to looking at it from a more roles and missions point of view.

Mr. Goldin: I'd like to add to that. The partnership council has worked very hard to assure that there's an integrated weather satellite strategy. And here is a perfect example of how we work across NRO and Air Force and NASA and NOAA. And as a result we're going to go from four weather satellite constellations to two. And we're going to integrate

with the Europeans so there will actually be three but the Americans will only pay for two. The Europeans will pay for one. And this is going to be a much more robust system. NASA will get its science. We'll do the development of the instruments and both the DOD and NOAA will get what they need. And the net savings to the nation is 1.8 billion dollars. So I think that there's a real movement forward in this arena and there's much more ground to be plowed, especially in the operational area.

General Myers: I would like to comment. I'll just pick on the piece that talks about the analogy with four Air Forces and the Department of Defense and how we're aligned in the space world. In terms of the services, there are lots of efficiencies in other areas and probably among the services as well, but I'd say they're minor. I'd say there's very little duplication or overlap between the Army Space Command, Naval Space Command and Air Force Space Command. Every service has a role to play and it's well integrated into the overall space effort. That's only going to get better in the future as we take the long range plan and then develop milestones and all the components, the Army, Navy, and the Air Force develop their supporting plans to support the long range plan so we know where we are along our road to the vision. I think that's going to force us out of duplication anywhere probably. And it will certainly expose it and we'll have to make the judgment whether or not that duplication or redundancy is needed. But I think the services today in their various roles fit very well together with very little duplication and overlap.

Mr. Augustine: Next question is as follows. *Realistically, when do you think we will have a manned mission to Mars? Dan that sounds like one for you to volunteer for.*

Mr. Goldin: We will not have a manned mission to Mars. We'll send astronauts to Mars.

Mr. Augustine: We walked into that! You have been corrected!

Mr. Goldin: The first astronaut will probably be a woman. We have a problem which I pointed out this morning. A mission to Mars will entail somewhere on the order of a million pounds of equipment that will have to be transferred there and with permanent presence about every other year. When the mission opportunities arise, a million pounds times ten thousand a pound is a lot of money. And it may be to

make the mission more robust we may have to take a million and a half or two million pounds-make it three-quarters of a million pounds. The barrier to going to Mars is not necessarily the equipment that goes to Mars, but getting off the surface of the Earth. It is going to be crucial that we solve this problem. Secondly there are a whole host of things that have to be solved and the next most important problem is how you provide medical care? How do you provide countermeasures to avoid the terrible problems of space? We'll build the international space station within a decade. We'll solve that problem. And then there are all the other technologies that go along which I also think are within the realm of a decade. So my assessment is we could launch such a mission no earlier than ten years from now and if we don't launch it within 20 years, I will be a very unhappy puppy.

Mr. Augustine: Thank you, Dan. Next question. Probably is suitable for both General Myers and Mr. Hall. We'll ask you to take them in that order if you will. It goes as follows: *What is the commercial community's obligation to turn off remote sensing satellites to keep from sharing that information with potential enemies during times of armed conflict? And secondly, what is the government's obligation to those companies when and if they do turn them off?* General Myers why don't you start and then Keith we'll let you follow on.

General Myers: I'll jump in and at least give you my impression. You know it's been US Space Command's position that it's good for the country and it's good for national security if US firms or even US firms in international consortiums develop commercial imagery or remote sensing capability. We think that's good and we've never opposed that. Primarily because if it's a US firm we think we'll have some leverage in times of crisis to turn off the pipe to potential adversaries. And that's been our position and I think that will continue to be our position. In terms of what the government should do in those times I don't think we've gotten to that point yet where we've thought that through or even if there is a government obligation. Because certainly there's going to be risk in operations like this when you're selling what can be used against you commercially. I think there's an obligation that in times of crisis they've just got to stop it. Their business case better take that into account. I guess that would be my first shot out of the barrel on that one.

Mr. Hall: I would just add that I think that the government

needs to develop a more coherent set of policies governing how we're going to treat commercial imagery. We lump it all together. Commercial imagery is that which is not done by the government. And when you look at commercial imagery, there's a variety of customers that they have. Some are civil, some are foreign governments. In the area of foreign governments which is the concern that you're raising here in the event we are involved in hostilities where the use of these systems could be detrimental to our national security, I think we can, with the development of effective policies, have arrangements with those allies to guard the information that would be detrimental to the US. Right now we're just in the beginning stages of developing the policies on this. This is an issue we have discussed with the commercial companies. Both the National Imagery Mapping Agency and NRO are engaging on this. And it's been pointed out to us that the policy today which seems to be more based on resolution probably isn't the right approach. A half-meter image of Greenland there is probably no national security implementations on that. A five-meter image of Aviano now might be. And we simply need to come up with a better mechanism and I think we'll be able to do that. So this will evolve and we won't have much longer to start sorting out these issues because with luck, the first commercial imagery systems of higher resolution will be launched by the United States within the next several weeks. So that will probably be the impetus for the government to get its act together and work closely with industry to sort out policies that make sense that allow our industries to compete. We have to recognize that these same foreign governments that are interested in acquiring the best technology available, which I would say is from US companies because of the billions of dollars that have been invested on the classified side, are a little bit nervous about issues associated with shutter control being imposed by the US government. We simply have to have some enlightened and reasonable policies in that regard and I think they'll emerge with the impetus that we're going to have when these become available this year.

Mr. Augustine: Keith here's one that a follow-on to the comments you've already made. *It has to do with a specific system mainly a three-meter radar-three-meter resolution radar-the question refers to as being pursued by Canada and other nations and yet the US appears to want to restrict this technology. Could you comment?*

Mr. Hall: Well in all areas associated with remote sensing I

think there's a degree of conservatism on the part of the government as we anticipate a world where these systems are more available to our adversaries. When you get to the area of radar it's of even greater concern because of the all weather day/night capabilities associated with that. And of course the United States conducts military operations in all weather and at night. And so therefore there has tended to be some greater conservatism in the types of information we would contemplate allowing out of the country in the area of radar imagery. I think that that too will evolve over time. I think that the principle interest in radar imaging capabilities are foreign governments. And I think in that case it will be an easier arrangement to craft the allowance of radar imagery going to foreign governments as long as they keep them classified than it would be for sales of radar data on the Internet, let's say. Which probably is going to be a long time before the government comes around to saying that we'll allow something like that. But this too is evolving and I think, unlike the electro-optical side, most of the radar imaging capabilities are in vu-graphs right now. They're not ready to be launched particularly the higher resolution capabilities. And I think we have more time to sort out the policies on that.

Mr. Augustine: This question I think most anybody on the panel might want to have comments on. It's: *Now that the Russians say they have found the money to keep MIR going they will need to use the Soyuz 204 capsules to send up their next MIR crew. Since NASA funded the construction of this vehicle for ISS, do we get our money back?* Dan, do you want to start?

Mr. Goldin: We did not fund that vehicle. What we did do is provide Russia 60 million dollars and in return we have received 4000 astronaut hours on the assembly phase of the international space station and so many cubic meters of storage space. Russia is a sovereign nation. Russia has to make decisions about what it does with its national assets. It is inappropriate for America to tell Russia what to do. However, the Russians have a commitment to the International Space Station and it is our position that the Russian government has to do what it says it's going to do to meet its commitment to the International Space Station. Our position was if they received outside funding sources for the MIR activity we had no objection as long as they met their commitments to the international space station. So we are not prepared to rush to judgment. We don't know clearly whether they're going to keep it up or not keep it up. We don't respond

to reports in the press. We have a quiet diplomacy. We will understand the issue and then we'll take action.

Mr. Augustine: Would anyone else like to comment on that? Ok. Let me take one for General Myers here. It's a question that has to do with national missile defense and the writer of the question points out that were we to deploy a national missile defense the enemy would revert to the use of biological weapons, suitcase bombs and other means that would circumvent the ballistic missile defense. And the question is as stated here: *Is missile defense aimed at past threats, not the future?*

General Myers: Well I think Bob Bell handled that pretty well earlier today when he said that technology for missiles is proliferating and that it's become a symbol of national power for many countries. So that threat, we think, is real. In fact that's one of our primary obligations here at US Space Command is to look at that threat very hard as it emerges from the intelligence community and put our operational spin on that as we provide recommendations to the Secretary of Defense next summer as we go through a deployment decision. We're going to be looking at that very, very hard. There are lots of threats to our security. You mentioned two. I would mention another one that nobody seems to talk much about right now but that's a cruise missile threat both in a tactical situation and in a more strategic situation where you might want to attack the North American continent. We can talk about that later or now if somebody wants to ask the question. I won't go into it but there's an area that we have very little capability and some would argue a pretty large threat.

Mr. Augustine: Dan did you want to comment?

Mr. Goldin: I want to come back to the other question that was raised. I think there may be some confusion about what we pay for. The Russians pay for their part. We pay for our part. But the Russians have designated certain serial numbers of the Soyuz that they pay for out of their own budget and the Progress vehicles for the space station. If the Russians divert those vehicles designated for the space station there will be a great deal of unhappiness on the part of the American side. Just for clarification.

Mr. Augustine: Keith let me address this question to you. *There are reports in the media that Serbia is using remote sensing satellites in Kosovo. If true and if provided by the*

Russians what impact, if any, would there be on US-Russian space ventures?

Mr. Hall: Well of course the NRO doesn't have too much going on with the Russians. Although I don't rule out that possibility at some point in the future. Clearly the advent of remote sensing capabilities around the world represents a new dilemma for the United States. And it's clear that you don't have to actually own a satellite to have access to the information from them. I think that the US military and US generally is going to have to get used to the fact that we are going to have to operate in an environment where people are going to be able to observe us more in the future than what we have been accustomed to in the past, and institute the necessary tactics and denial techniques that are appropriate for that situation. I don't know the details surrounding what the Yugoslavs may or may not be getting this regard. I do know that one of the things that are most important in tactical situations such as this is the timeliness of delivery. My guess is that much of the information of a sort a general strategic nature as to what is NATO's activities and intentions and all the rest are probably available on CNN and there wouldn't be much that remote sensing systems would add to that. And it would only be that information that's provided on a very timely basis I suspect that would be of a greater utility to the Yugoslavs. And I don't believe that those capabilities are as readily available to them as they are to the US side.

General Myers: Let me just tag on to that. As Keith said, this is a classic space control mission if that were true. And that's one of our responsibilities here at US Space Command. We look at that very closely and to date we don't think that there's any information coming from or through space that contributes at the operational level or tactical level to Serbian capability. And that's all I need to say on that I think. But that's something we watch very, very closely.

Mr. Augustine: You know coming back to the previous question about circumventing a ballistic missile defense system or other threats, it reminds me of one of the darkest moments I had on television live. I was asked a question about that and I was trying to make a point that it's not sufficient to defend against ballistic missiles but one also has to worry about cruise missiles and aircraft and even people sneaking threats in across our borders-nuclear weapons across our borders-or at least atomic weapons. And the interviewer was very impatient with my answer and very skeptical of

what I was saying. And the interviewer looked at me and kind of snidely said, "Well how would you ever sneak an atomic weapon across our border?" And without thinking I blurted out, "Well you might hide it in a bale of marijuana!" To this day I've regretted that comment.

Moving ahead quickly, Keith this one is aimed at you but I think several of the panel members might want to comment on it. It relates to commercial imagery. And the question is as follows: *Current ITAR policy is defeating your goal of dominance of global markets. We can't compete in international markets because of the lack of quick, sound decisions from the State Department. Help! What do you recommend? Strong letter to follow.*

Mr. Hall: Well you know I think that what we are seeing in the licensing process is that the first license that's put forward for a capability to be sold abroad takes a long time. And hopefully the other ones that come through of a similar nature go through in a much quicker fashion. I personally believe that we need to be a bit more agile in the licensing process. There are many cooks in the development of this soup. And the delay isn't really just the State Department. The intelligence community, the Commerce Department, the Defense Department in its various capacities, both from the military and the OSD side, all get to weigh in and it's a very deliberative process. It seems to me that we could set broad policies with regard to what it is we will allow our companies to market abroad. And set up a policy framework that says that as long as you stay within these lanes in the road you will have every expectation of getting a license approved by the government. I don't know whether or not there's anything I could say that would guarantee a swift reaction from the government on anything. And we can't lose sight of the fact that some of the recent activities associated with missile technology transfer to China has caused the government to become perhaps even more conservative in the approach on these things than in the past. Hopefully that's just temporary. But I think there's a big difference in the types of sales that are being provided for in the license requests. And I for one would say for example that the marketing of the remote sensing system to one of our close allies should not be treated the same way as a license request to provide a capability to someone that is not a close ally of the United States. And I think we just need to have more agile policies in this regard. And we've been advocating that within the interagency arena. And I think that as time goes by we'll find that course across

the government agencies.

General Myers: Can I tie on to that just for a second?

Mr. Augustine: Please.

General Myers: It's not just in commercial imagery where we have this sometimes lack of backbone inside the beltway. Sometimes, it's over organization of the issue inside the beltway that frustrates national security interests. It happens in imagery because we want a robust commercial sector. We want to buy some of that imagery. The Secretary of Defense announced Monday in his videotape a huge increase in the amount of commercial imagery that we're going to purchase. But there's another aspect and that's our EELV and the reliance on the Russian RD180 engine. Unless things have changed in the last week that's been a ping pong ball between Congress and the State Department. And that has our direct interest because we're counting on EELV to get our launch costs down. I go back to Alvin Toffler's remarks earlier this week in the morning when he said we need to "demassify." We need to realize we've been in the third wave net for a while now and our structure and our processes just aren't responsive like they need to be. So we need to change them and the sooner the better.

Mr. Augustine: *Dan, should the United States start the development of a crew transfer vehicle as an alternate to human transportation to space? Would this represent revolutionary thinking?*

Mr. Goldin: Well if a crew transfer vehicle is developed that goes on top of an EELV I don't think it would be revolutionary. But it would be another way of taking people into space. And if the cost of doing that is reasonable and it doesn't detract from the mainline issue that I have brought up of cutting the cost of access to space, I'm all for it. But if we are to go develop a crew return vehicle using existing technology and it bleeds the very meager resources we have that could be applied to solving the problem once and for all, I would be very much against it. We do not have an understanding yet of how much a crew transfer vehicle would cost, how long it would take to develop and what its impact would be on other activities that we have. I will say that there's a concept that we're working on called the X37 with the Air Force. Maybe not that exact vehicle size but there are some very interesting fallout possibilities from that and we might want to consider a combination crew return vehicle and

crew transfer vehicle. So there are multiple possibilities and we want to keep all options open.

Mr. Augustine: Here's a pair of questions that Keith I'll ask you to address the first part and Dick perhaps you'll take the second part. *What is your perception of the US Army's role and participation with the NRO and its activities and future plans, and how would you like to see the Army participate?* The second question is, I guess, indirectly coupled and that is: *How well do our space capabilities support the kind of war we and our NATO allies are now fighting or may be called upon to fight? And are there any changes that are needed that you could discuss?*

Mr. Hall: With respect to the Army I think that the main interaction that is appropriate for the Army vis-à-vis the NRO is the organize, train and equip question that I raised earlier. The Army has long had-as a matter of fact the Army was the very first to develop the tactical exploitation international capabilities office. They did that in the early 70's recognizing the potential that these reconnaissance systems have to support Army operations. And the Army is doing some of the organizing, training and equipping to use it and pay a lot of attention in studying it. The perversity of the budget process and the priorities on it and the cloak of secrecy that has heretofore made information about this difficult for the senior Army leadership--not the Chief of Staff or someone like that but the one and two-star levels in the Army--makes it more difficult to compete well in a budget process that is chasing other priorities. So what we have been doing is reaching out via the Space and Missile Defense Command, General Costello, General Anderson before him, to make our capabilities known; make it known that we are prepared to allocate dollars on the NRO side to do our share of making a connection if they respond in organizing, training and equipping to utilize the information. And I think we're making some progress there.

I think when you look at the second question, I think it's becoming increasingly clear in the types of military confrontations that we find ourselves in that not only NRO capabilities but space capabilities generally are in the fight today in ways that they have never been in before. And the comparison between the systems as they are being utilized in the Iraqi situation, which has sort of taken a back seat lately to the Kosovo situation, between the Iraqi northern and southern no-fly zones, Kosovo and the Afghan strikes last

summer and the role that space played, is absolutely eyewatering. And I think that each of those areas-Afghanistan, Kosovo and Iraq give us examples of the differences that exist in the types of information requirements and command and control and navigation and so forth that are facilitated from space that argued very elegantly I believe for the type of integration I was talking about before. There often are not silver bullets that you can fire at these things and you need to have a variety of capabilities in your kit bag-space among them-that can be utilized. And I think it's safe to say in Kosovo the airborne assets were the basis for a lot of them or close to the Kosovo region are probably playing a greater role than they did generally in Iraq. And virtually were nonexistent in the role in Afghanistan where it was almost entirely a space show. So I think across the ISR arena we need to have a range of capabilities that can be tailored to the circumstance and it's encumbered upon us, as I said before, to make this as transparent as possible to the users because they're interested in getting the information whether it be from commercial imagery, an NRO imaging satellite, an airborne system, a UAV, a U2, what have you, is really not the issue. It's using the best capability that meets the circumstance at the time. But I think that the daily reports that I see on the situation in Kosovo and the contributions that the space assets are making are things that I take pride in as well as my predecessors should take pride in for the improvements that have been made since DESERT STORM in connecting these things and bringing them into the fight. They are saving lives and they are tremendously aiding in the precision side of the strikes.

General Myers: I have talked several times with John Jumper who is of course the Commander of our Air Forces in Europe and responsible in many ways for the planning and even the execution of the air war. And he's delighted with the space support he gets today. And I would guess that if General Chuck Horner were sitting here and knowing what he knows about our support today and contrast that to his experience in DESERT STORM that he would say that we've come a very, very long way in pushing space down to the operational and tactical level which we had not thought through and done very well prior to DESERT STORM or even for that matter during DESERT STORM. So we've made a lot of headway but we're not near where we need to go. There are systems that Keith knows about that are relatively-and some that he probably doesn't know about-

although he knows a lot-

Mr. Hall: Get out of this one!

General Myers: ...that for just a few dollars would have been in the kit bag for Kosovo that aren't in the kit bag. And so we still have to find better ways to keep pushing this information down to the level where it's really, really needed. I think we do a pretty good job of that today. We've really focused our attention on the area. We get a lot of kudos for our support but I guess I would say, we can do more. And we will do more. Part of that is the issue of education. We've sent joint space support teams from the Joint side of our business into Stuttgart to help EUCOM with their planning, and NATO for that matter. And why we have to continue sending folks out to tell them about space is that space knowledge is not resident on the staff. And so our educational efforts need to pick up the pace. They have. Most of the schools-I was just at the Army Command and General Staff in Leavenworth-they have a very robust space elective that a couple of years ago maybe 20 students would want to take. Today at 160 they've got to turn them away because they don't have the classroom size or some of the other computers and things that they need to teach. And they teach it at a couple of levels-at a Top Secret level and a Secret level. So we're making headway. I would also point to the Air Force Weapons School, which has a Space Division, and these are the smartest folks-they know everything about space from heat to light. They study it all for six months. If you can get your hands on one of these folks, they can really bring space to the fight in ways that we-the generals-haven't thought of. Their IQ is still pretty high because it is a constant and most of them are Captains so their IQ's are way off the chart. I think we have great interest from the Navy and the Army in putting some folks through that school and staying on as instructors and then populating the classes with Army and Navy and Marine students. General Hawley thinks he can do that with his resources at Nellis and the services have told me that they're willing to go ahead with that. So that's all part of the education process. And I would just say one other issue and that's back to space control-assuring our access and denying an adversary's access in times of crisis. We're prepared to do that as well in Kosovo should the need arise.

Mr. Augustine: You mentioned education. Let me turn to a different kind of education. And it's a question Dan that I know is near and dear to your heart. It has to do with the

importance of education with regard to this bringing the young people up who can develop a kind of a space program that we all hopefully might see. And in particular, ***What is there that NASA is doing and might do in the future to engage students in space exploration, space activities and in particular using web-based systems?***

Mr. Goldin: It is our objective and it's going to probably take a good three to four years to engage the students on the web in all the scientific endeavors we have. We had a situation when I came to NASA and I found that scientists who were paid with US taxpayer dollars were given a one to two-year hold on the release of the data that came back from our interplanetary probes. And that was a condition that was unacceptable. We were going to get all those contracts out from behind us. And then our intent is to make the data available to anyone, anytime to set up training procedures and to utilize students to analyze the data. We've run some experiments and it does your heart good to see what children could do in schools. And this is a major activity that we want to pursue. Corporations are working with us and we intend to make that happen. I'll give one little vignette. About a year ago, you called me up and said, "You know, wouldn't it be a good idea to fly an airplane on Mars to celebrate the 100th anniversary of powered flight and when you do it why not involve students in the design of that plane?" Well, we may not be able to get students directly involved initially but we have set a goal of having the students involved in designing a whole series of planes because this will not be the first one. And we intend to work with universities and high schools and junior high schools and we are going to involve students in the design of these planes. We intend to involve students in the design of many things we do. There was a recent book written by someone named Kevin Kelly from Wired magazine about things going on on the net where some of these start-up companies will put real problems that they're having on the net and they'll let the debate go on. We intend to do that at NASA especially to stimulate children. The part that's very disturbing is our education budget is nowhere near where we'd like it to be and we're going to try and work with the Congress in this session to try and increase it.

Mr. Augustine: Dan, thank you. Keith, could I ask you this question? ***Might the sanctuary of national technical means that's assured by the ABM treaty be compromised by NRO cooperation with DOD or NASA? And particularly with regard to sharing platforms such as Discoverer II?***

Mr. Hall: I'm not sure I understand the question, but I think that the capabilities that Discoverer II seeks to develop is inherently a tactical capability. Let me tell you what I see as occurring and I addressed this at the senior executive lunch that we just had. You know in the past the military mission was one that required surveillance-like capabilities but the sensors didn't have to be all that capable. The best example there is in the missile warning category. You needed to make sure that you could detect an ICBM burning but that's pretty easy to detect and do so on a 24-hour-a-day worldwide global basis. The intelligence mission was one that required much finer capabilities in terms of quality of the sensor. Which drove up the costs of them which means that you couldn't have too many of them and the notion of a surveillance capability with that type of expense was out of the question. What you see happening on the military side is a drive to have ever-more capable sensor systems and SBIRS is a good example of that. You not only have to see the hot burning, long burning ICBM, you have to see the short burning dimmer targets associated with theater missiles. And that means you need a much higher quality sensor but you still need it 24 hours a day seven days a week. Some of the tactics that are being employed against the intelligence reconnaissance satellites are making it difficult to cope with the denial aspects and potentially deception aspects. So the intelligence community is looking at ways to improve the approaching surveillance. So what I see is a convergence of the two and the Discoverer II program is a good example of an effort to try and have it both ways. A high quality sensor that can be deployed in great numbers and be utilized across the intelligence and the military domain. Now we have looked at notions of having foreign partnership in this and I think that as you look down the road you have to anticipate that when you're talking about constellations of 24 or 48 satellites necessary to get a surveillance-like capability from radar that even if we are able to bring the costs down that the advantages of having some international aspects to this constellation with our allies becomes somewhat attractive. I don't think there are any ABM implications to any of this. I think that its the more standard questions I was discussing before relative to remote sensing and the government developing policies associated with the release of the information on an international basis and working with foreign governments. But I think that we're going to see more of that. The space based SBIRS Low for example, a very high quality sensor system deployed in great numbers, that if the

US policy achieves its purpose we will never use that system for the purpose for which it's designed-national missile defense. If we have those 24 satellites up there in low earth orbit, gee, what else might we do with that? And technical intelligence is an obvious other mission you could put on it. Space surveillance is another. So I see a convergence in the military and the intelligence arena that's occurring that can be fostered by R&D and cooperative developments at this stage. We'll need to make some cultural changes in our organizational arrangements. And those are probably the more intense battles than anything associated with the international arena.

Mr. Augustine: Here's a career-limiting question for General Myers.

General Myers: So be it.

Mr. Augustine: *What do you think of the idea of gaining some support in the United States Senate of creating a Space Force as a fifth service?*

General Myers: This debate's been going on for quite a while. I've been asked that by some senators and some congressmen as a matter of fact. Here's my view. You've got to ask yourself what you're trying to fix if you want another space force. And I think what we're all grappling with when we talk about separate space forces or major force program for space or so forth is the resource issue. And that's a legitimate issue. And if that can be solved by a separate space force or a space corps or whatever, then we ought to do that. I guess my view is that I'm not so sure that those kind of movements are going to create additional resources for Space Command. What I worry about is the continued integration of space into all our activities. And today because of the way we grew up, as a series of science experiments, we're still in the business of operationalizing what we do in space. That's what my predecessors who have great operational experience including General Estes and General Ashy and General Horner and all the way back have tried to do. And as I mentioned earlier, there's a long way to go. We still send out teams to European Command, to USAFE (United States Air Forces in Europe), when they want space expertise. I don't think they ask for teams if they're wondering how to employ the Theodore Roosevelt battle group. I bet they don't ask for teams to come over and tell them how to employ the F15E. And so my view is this is not the time to take space and put it over in a corner where it once was and expect it to have the

impact on our forces today that we think it can have. Now in the future, in 20 years or wherever, when we have spaceships roaming the galaxy then it might be time to look at a new service, a new space force. I guess that's my idea. So my focus, and I think everybody's focus right now, is on integration. They often come up and say, "Well, the Air Force isn't doing its job vis-à-vis space." I wouldn't put it that way. There is no question that since the Air Force bears the larger burden in space that they are committed. Absolutely committed. But it comes down to priorities of resources and when you're fighting a conflict where folks are in harm's way it's hard to say let's don't buy some more arms-shooting F16s if we need them versus other systems that have maybe a longer term payoff. Difficult situation but it does not speak to the commitment of the Air Force. The Air Force is certainly committed. That's been a side issue throughout all this. So it certainly is a resource issue. I think the work being done by the Defense Science Board that Pete Aldridge is chairing on space control and surveillance that they can make a very powerful statement about resources. I think the work being done by the Boren-Rudman Commission with Chuck Boyd kind of being the secretary of that group--I think they can have a major impact on where our resources in the future go. And I think we're going to have to make some choices here fairly quickly--probably should have already made them--about resourcing the space mission more adequately. But I'm not sure that I believe it's solved by a separate service or separate force program.

Mr. Augustine: There's something of a footnote question to that and I'll paraphrase it a bit and ask you if you'd comment and Dan maybe you also would care to comment. And it has to do with *whose responsibility should it be, if anyone's, to deal with the protection and deflection of potential earth impactors?*

Mr. Goldin: I'll start and say clearly it is not NASA. But what NASA is responsible for, and needs the help of, is the detection of these bodies. I mean we know that they've crashed into the earth. We know that they're out there. But we also know that there's a limit to what we could do. And by teaming with the unified Space Command we've been able to set up a program that meets the Congressional mandate to detect 90 percent of the near earth crossing asteroids within a decade. We've put additional people on the subject and we feel that we're going to get there. But just detecting them is not enough. You can't go out, or you shouldn't go out, and

develop a weapon until you know whether you need it (a), and (b) how to make that weapon effective. You have to understand the characteristics of these comets and asteroids also. And we will be spending well over a billion dollars, I think we're going to send six or seven spacecraft out to fly formation, to land on, to bring back samples from, to drill into these bodies. That will give us our first sets of clues and then we will press even further. And then when we understand the distributions, we understand the possibilities, we could dig deeper into it, and at that time-- the ball's in your court.

General Myers: For our part we're looking for a few folks of the Bruce Willis ilk who are willing to man these missions. But other than that, that's the program to date and that's where we're focused. And that's the surveillance part.

Mr. Goldin: Can I come back to another issue? Because after I gave my talk this morning a couple of people approached me and I think they got a wrong impression about what I was saying. I wasn't proposing the immediate elimination of the shuttle. I think the USA team is doing a superb job and we intend to give them ever-increasing responsibility when they're ready. The shuttle--if you take a look at one of the charts I showed--at the very earliest the shuttle will be ready for replacement some time about a decade from now. So the shuttle will be there and that will be our primary vehicle to get into space. Until someone comes up with something better than the shuttle, it is the real reference--anything else are scribbles on a piece of paper. I am encouraging the USA company to take a leadership role in seeing how we could accommodate revolutionary change to the shuttle. The shuttle has a pea-sized computer. If we gravitate intelligence into the shuttle, or if we have standard payload interfaces--if we use intelligence in our processing on the ground, there is some great headway to be made. And if we replace things like the hydraulic system with electromagnetic actuators and there are other possibilities--getting rid of toxics--they could make great progress on the shuttle. Competition is wonderful. It's what makes this nation great. And we don't want the folks on the shuttle to give up because they are a reference point. However, we're going to invest long term R&D that might apply to the shuttle, but what I would like to see happen is a fire start burning across the country that there are revolutionary technologies that we need and to have some real competition, not paper competition. And we intend to work with every organization. We'll have partnerships with rocket companies on our technology. We'll transfer them to

them. If they want to come to our facilities and use our testing, we'll use it. If they want our expertise, we'll give it to them. And we're going to work real hard to make this happen. And as I said we're going to try and get some more money. If we don't get that, we'll squeeze efficiencies. If we have to cancel programs, we will. You've got to prioritize in this world. Life is about prioritization. And I want to come back and say, access to space is crucial. And I hope everyone in this room that cares about space understands that.

Mr. Augustine: All right. Since the NRO is responsible for defending against earth impactors-- That's the way it came out wasn't it? Referring back to a comment earlier today in an earlier briefing where it was pointed out that space control is right where it should be, *when does USSPACECOM expect to have the ability to defend satellites on orbit? Is satellite protection and defense a priority for the NRO?*

Mr. Hall: Well I think that there's a number of ways that one can defend satellites. You can defend them with encryption. You can defend them with detection sensors that can sense when it's under attack and take appropriate actions. And then there are other ways of defending it that involve perhaps traditional military activity. Bombing or blowing away the threat on the ground if it's terrestrial. And of course the space-based ones. These are obviously important questions in the space control arena. And I think that the program as was pointed out by Bob Bell this morning lays out a coherent plan. I think some of us might want to see it go a little bit faster than what the path is that it's on. But I think that it is coherent. It's comprehensive and addresses all of the areas associated with this arena. I think from the government side that's one aspect. I think the commercial side is a bit more troubling. Secretary of the Air Force at a space conference back in December-the issue of protection of commercial satellites came up and the panelists that were speaking on behalf of the commercial side basically said well we look for the government to sort of defend us and we're not prepared to spend a lot of money on things ourselves to handle this protection. And I don't think that over the long term that is a viable policy, particularly since from a national security point of view we place tremendous reliance, and increasingly so, on these commercial type capabilities. So it's been mentioned at other times during this conference but I think it bears repeating that the protection is not just something from afar that we'll come in and save the day. It's going to require investment of both the government developers and operators

of payloads as well as the commercial side. And at some point I have a joke I'd like to tell about the asteroid impact, but I'll refrain from that at the moment.

Mr. Augustine: Please tell us.

Mr. Hall: All right I will. Thank you. The year is 2050. There's an asteroid heading to impact the Earth and the technology has been developed to have that asteroid veer off course, but it's a one-way mission. So the NASA Administrator seeks volunteers to undertake this mission. And an Admiral, an Air Force General and the NRO Director all apply. When they come in for the interview with the NASA Administrator, the Admiral comes first, the Administrator says, "What is it going to take for you to take this mission?" The Admiral says, "Well the only thing I ask is that you give a million dollars to my alma mater-the Naval Academy." Says, "Thank you, very much." Calls in the Air Force General. Asks her what it's going to take to have her take the mission. She says, "Well I'd like you to give a million dollars to my alma mater, the Air Force Academy. But also, since my family isn't going to have me around anymore as the bread winner I would really like to have a million dollars to go into a trust fund to support my family, and so forth." Says "Fine" and calls in the NRO Director. "What is it going to take?" "Three million dollars." "Three million dollars? What for?" "A million for me, a million for you and a million to send the Admiral."

Mr. Augustine: Good news-- there's only ten minutes left!

General Myers: Can I tie into that last question? I'd take a lot less actually, if it were me. But let's talk about space control because that's the question that was asked. And Keith did a great job of answering it. But it was really the essence of it I was trying to get across yesterday. And the problem we face today is that many times with anomalies on orbit you don't know why you're having an anomaly. And if that's not scary, it ought to scare you. I mean, talk to the Hughes folks here. My understanding is when Galaxy Four failed it took several days before we knew what had happened. And of course, there was the, now we know, hoax of some hacker taking over the British military communication satellite Skynet which we have backup capability to fly here in Colorado as a matter of fact. But if somebody had taken that over, they were going to run it out of fuel unless they were paid ransom. Probably pretty far fetched. It would take an inside job no doubt. I hope that it was secure enough where it would take

some insider to do that. But not beyond the realm of the believable. So I mean this is a really multi-faceted question that requires all of us to delve into. And surveillance is a big part of that. Of all the subsets of space control-the surveillance, protection, prevention and negation, we're working each one of those. And some of them are technology efforts. Some of them are more robust efforts. But we have to work all those on kind of a frontal attack on the whole problem. And each piece is being addressed. But there are no simple answers. And if you asked the cavalry to come calling today my guess is, between us, we might be able to help in some cases and in some cases we might not be able to help. And that's unacceptable I think for this country. And so we're working on that. But we're not anywhere near where we need to be.

Mr. Augustine: We have exactly ten minutes left. Let me just kind of alert the panelists that the last question I'd like to ask for each of you to address if you would, would be just very briefly, *what do you see as the most significant accomplishment within your organization this past year? And what would you hope would be the most significant accomplishment you could point to next year when you gather at this same meeting?* If indeed after those jokes, we get invited back! While you're thinking about that, let me proceed ahead with some questions. Dan this is for you. *What is the NASA Administrator's view of Russia remaining in the critical path of ISS and what is the net cost to the US taxpayers in terms of dollars?*

Mr. Goldin: Let me start by saying I think the Cold War is over and I think we've beat the Soviet Union. One of the issues that America has to undertake as we transition from the Cold War to some new global situation is we can't take the past and put it into the present and change behavior. We could talk about critical paths and we could talk about who did what to whom, but the issue is without the Russians, I don't know if we would be able to build the International Space Station. There's a sense that the Russians are incompetent, sloppy, not caring about safety. And when we went there they changed our view of that. The Russians have the Progress, the Soyuz, and the Proton-outstanding vehicles -- among the most reliable in the world. The vest panel said clearly bring in the Russians because if the shuttle is down for a year or two, you could lose a huge multi-billion dollar 15-nation asset on orbit. The primary reason we went to the Russians is backup launch capability, which still exists with some of the finest launch

vehicles in the world. The Russians taught us about what it's like to be in space for long periods of time. And had we built the station without the learning we had of the Shuttle/MIR program, when everyone rubbed their hands and said, "Oh my God, something could go wrong." I've got to say-it was an unbelievable success. It was incredible, the teamwork, the partnering that went on between the Russians and Americans. I have to say the Russians were unbelievably gracious and gave us a lot more than we have given them-openly and completely and unselfishly. During the height of the Cold War, the Russian economy was about 60 percent of the American economy. Today it is 1/22 of the American economy and sinking fast. We have to be really careful as we look into the future and ask about what are some of the consequences of a nation with a multi-trillion dollar economy not being able to deal with this and be adaptive and treating the Russians as though they were some second rate group of people and we could do with them or not do with them. Now clearly they have to live by the rules of international prudence and do the kind of things they committed to do. But we have tens of thousands of Russians who have a very positive interaction and relationship with the United States and that space station is up there because the Khrushchev Company built the most incredible piece of hardware the FGB, now called Zarya. The Zarya was built in Russia. The unity module was built in America, ten-thousand miles apart. Ten thousand miles apart. Never integrated together. And with some two dozen hours of astronaut time we hooked it up electrically, mechanically, information-wise. I'd like to see any other two groups in the world do something like that. And we need to take our rhetoric down a little bit. Now clearly there are some tensions through the other international goings-on, but if America wants to be a world leader, and we are the leader on the International Space Station, we're going to have to grow up a little bit. And I'm not saying that Americans are bad or the people involved are bad, it's just that we need to have a little bit of knowledge. And if we want to lead, we have to be the first to put out our hand and understand we have an American investment something on the order of more than \$30 billion dollars. When I was in the private sector, if I had a supplier that was in trouble, I wouldn't give speeches and talk down to them and berate them. What I would do was say, "Let me help you through this problem and then we'll see you in Court later." We need to think about the implications of what we say and what we do and Americans are very giving, outgoing people. We have

other wonderful international partners-the Japanese, the Canadians, the Europeans and now the Brazilians. If we want to be world leaders we have to start acting in a leadership capacity. (applause)

Mr. Augustine: Thank you Dan. *Keith, what was your organization's greatest accomplishment last year and what would you hope it might be next year?*

Mr. Hall: Well I often tell my work force that the predicate for anything that the NRO will do in the future, which I think is evidenced by our attention on the future, by the R&D expansion that I mentioned earlier, but the predicate for anything that we'll be able to do for our country in the future is really excellence in operations on a daily basis. I think if you look back over the last year and say, "What is it that the NRO has done-the major accomplishment over the last year -- it's clearly been in the support that we have provided with our mission partners-NSA and the National Imagery and Mapping Agency and others, using satellite data in support of the national command authority and our military leadership in the crises in Iraq and the terrorist bombings in Africa and the Kosovo situation. There are numerous examples-all classified obviously-but numerous examples that I think would make all of you proud of the work that industry and the government team have done to protect American lives, promote American interests and those of our allies that flow from the accomplishments that start with the NRO's satellite operations over the course of last year.

If I look at the thing that I'd like to be able to say next year about our accomplishment, it's successful deployment of the post-Cold War satellite architecture. We made investments starting in the early 90s and were accelerated in the latter part of the 90s that are going to lead to the deployment of a new generation of what I call post-Cold War architecture for the NRO. We are thinner in terms of our capabilities than we've been at any other time in the past. And the success of those launches and checkout on orbit and so forth of these satellites will be critical over the course of the next several years. And I certainly hope that I'll be able to say this time next year that that has been our accomplishment-the successful launch and checkout of this new generation of satellite capabilities.

Mr. Augustine: Dan?

Mr. Goldin: The crowning achievement for NASA last year I have to give to: We flew a 77-year old man and it was a

wonderful scientific achievement which the results will be out, I don't know, a year or two from now, but it electrified America. And at a time when as a nation we were looking inward, to see the smiles and to see the feeling of pride that this nation had in what it could do, I think that says it for me. And why don't I stop with that as an achievement.

The space program is not only about technology. It is about as a nation we come together to do real positive things. For this next year I'll be less esoteric. We're going to have to launch more payloads than NASA has ever launched in the last 25-30 years. Don't wish for something-it might happen. Faster, better, cheaper is working. And next year I'd like to see a real good scorecard of tremendous achievement showing that-and it's not NASA-it is the contractors who work with us; it's the University community; it's our international partners and the NASA employees. And I hope that everybody in the nation will take pride in what this incredible team did.

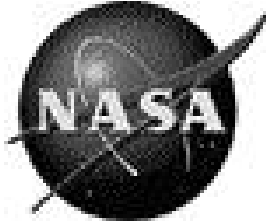
Mr. Augustine: General?

General Myers: For this year there are probably many, but I'll just focus on two. One is, I think, we've taken our space support to the warfighter perhaps to even new levels this last year. There have been many operations we've been involved in. The staff has worked very hard with the theater commands to provide the kind of support that they want. I think we have great dialogue and great credibility. And so I think we ought to take a lot of pride in that. And the other one would be that the Long Range Plan that General Estes unveiled last year about this time is exactly what we're proud of this year because now we're starting to put meat on the bones, develop all the subparts of that plan, and the milestones that tell us where we are along the road to our vision. So I think the reorganization we've done in the headquarters to do that are probably a couple of things we ought to be proudest of because both of them take a lot of hard work and dedication by some very, very good people and a lot of cooperation with other people to include industry.

Next year, if I'm invited back, what better have happened is we better have figured out how to at least initially organize ourselves for this new responsibility in computer network defense. If we're going to have that responsibility for the Department of Defense and perhaps for both militaries of Canada and the US for North America, we better have done our work between now and next year. And we'll give you a good report on that, like I say, if asked back. And the other

part of that is, about this time next year it's just going to be a month or so before Secretary Cohen will recommend to the President on whether or not to deploy national missile defense. And so I hope one of major accomplishments between now and then is to make sure that we have sorted out the battle management, command and control and communications, conops and architecture where we are comfortable with that; that we have thought about the threat and provide our best operational advice as the user to the Secretary as he goes forward to the President. So we have a lot of work to do in both those areas and those are probably what we're looking forward to next year.

Mr. Augustine: Let me close by thanking you for your very good questions, thanking our panelists for their very good answers. As I said, it's been an honor for me to be on the same stage with you three gentlemen. And it's of course one of the great privileges of life to be able to be a part of something as exciting as a space program with a group of people like you. So, thank you very much. We wish you all Godspeed.

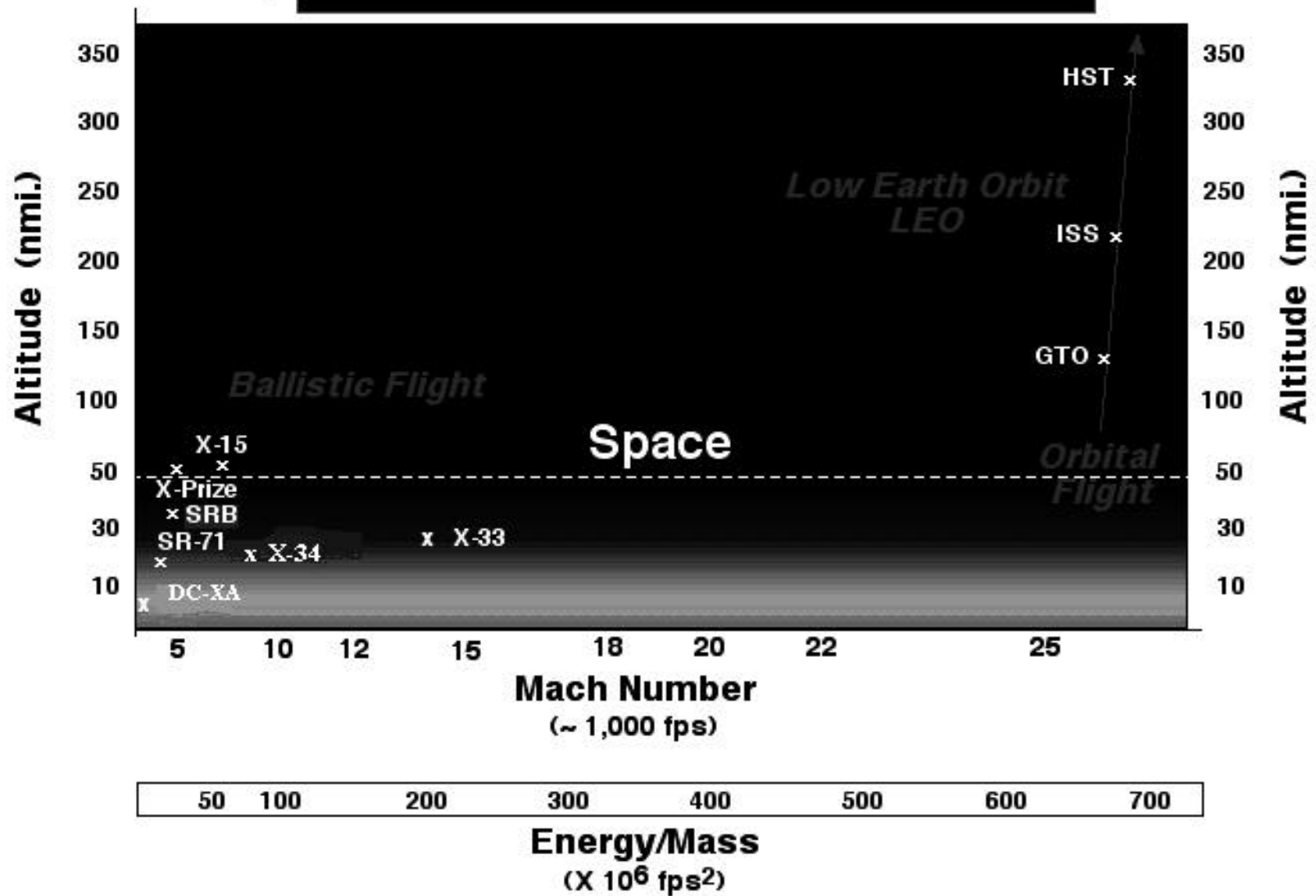


Daniel S. Goldin
NASA Administrator
United States Space Foundation
Colorado Springs April 8, 1999



Shuttle/RLV/Commercial Transport Aviation
Historical Perspective & Background

Space Flight -- a function of energy



Why is the Space Shuttle so 'complex'?

Unlike an Expendable Launch Vehicle (ELV)
whose lifetime is less than an hour from lift off to reentry,

The Shuttle is:

A human-rated rocket ship for eight-and-a-half minutes,

A spacecraft for ten days to two weeks,

a habitable research platform, capable of rendezvous, docking,
deploying, retrieving, repairing and

supporting spacewalks for space construction,

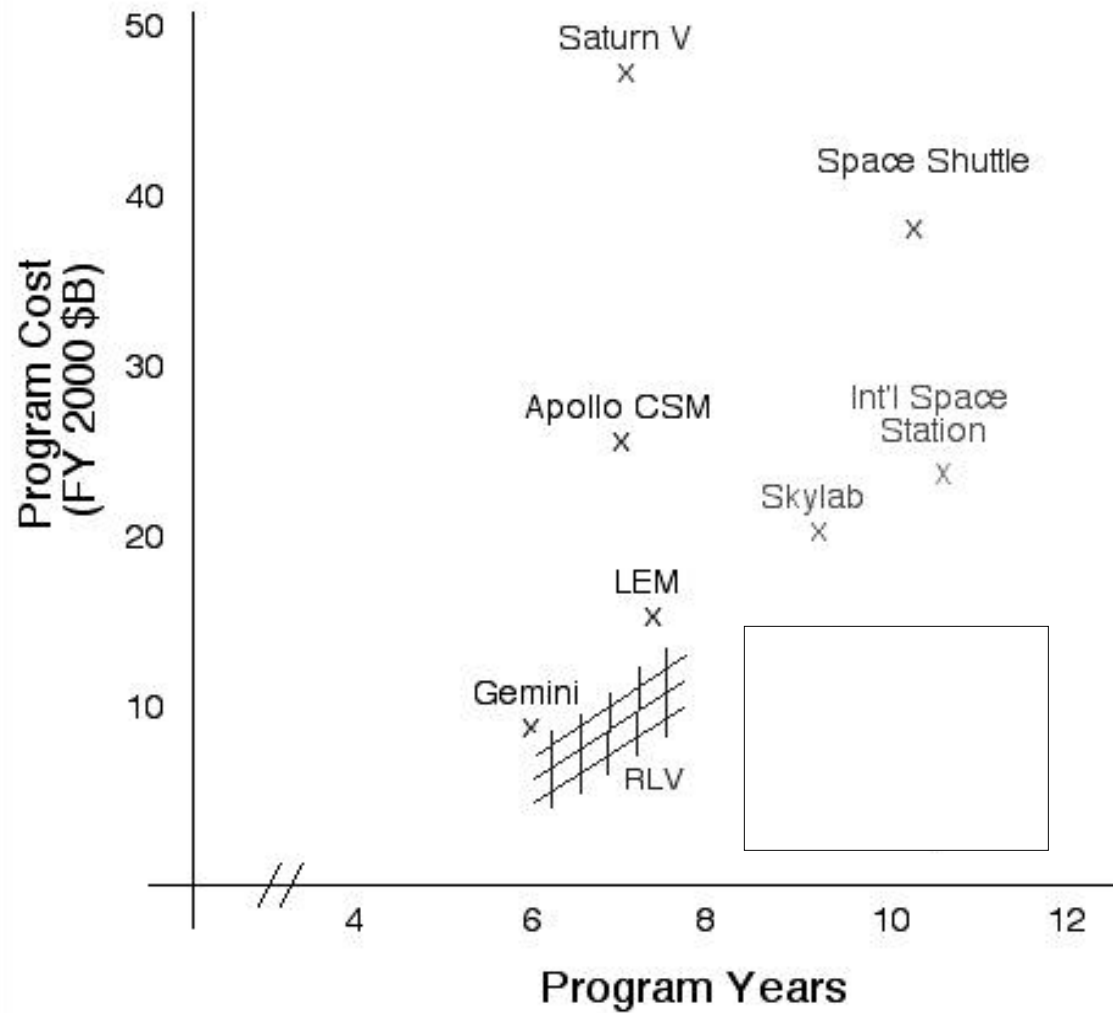
A hypersonic reentry vehicle for an hour,

A piloted subsonic glider for about five minutes.

The Shuttle is certified for 100 missions,

each lasting from five days to almost three weeks duration.

Historical Program Cost



Six and a half Airliner Generations

Wright Flyer	1903	1 'seat'	40 mph	fabric/wood
Ford Trimotor	1927	12 seats	110 mph	aluminum
DC-3	1933	21 seats	180 mph	aerodynamic
DC-7	1953	105 seats	360 mph	supercharged
Boeing 707	1954	147 seats	550 mph	turbojet
Boeing 747	1969	385 seats	550 mph	turbofan, wide-body
Concorde	1969	144 seats	1350 mph	supersonic mach 2.05
Boeing 767	1981	211 seats	550 mph	twin-jet, glass cockpit
Boeing 777	1994	360 seats	550 mph	fly-by-wire

First Generation Reusable Launch Vehicles

Space Shuttle 1981

When will the next generation happen?
What will the next generation look like?

Order of Magnitude Analysis

Shuttle

3-4 Flights a year

Depot Maintenance every 10 Missions

100 Mission Design Life/?? Years

Airliner

1000 Flights a year/3500 Hours a year

Detailed Structural Inspection every 25,000 Hours

25,000 Mission Design Life/20 Years